03-08-00

UTILITY PATENT APPLICATION AND FEE TRANSMITTAL

(Only used for new nonprovisional applications under 37 CFR. 1.53(b))
(PTO/SB/05 and PTO/SB/06)

A

Case Docket No. SG 99428
Date: March 7, 2000

ASSISTANT COMMISSIONER FOR PATENTS
Box Patent Application
Washington, D.C. 20231

jc658 U.S. PTO
03/07/00

Dear Sir/Madam:

jc682 U.S. PTO
09/520087
03/07/00

Transmitted herewith for filing is the patent application of:

Inventor(s): Valerie Anne Scott, Alan Edward Green and Euan Morrison

For: *OPTICAL SIGHT*

X Specification (11 Pages), Claims (2 pages), Abstract (1 page) and (2 sheet(s) of Informal Drawings)

X Declaration and Power of Attorney

___ An Assignment of the Invention to _____

___ An Information Disclosure Statement

X A Certified Copy of Great Britain application(s) No.(s) 9916676.1

___ A Verified Statement to establish Small Entity status under 37 CFR 1.9 and 37 CFR 1.27

X A Preliminary Amendment

X A Filing Fee, calculated as shown below:

	Column 1	*Column 2*	*SMALL ENTITY*			*LARGE ENTITY*	
FOR:	NO. FILED	NO. EXTRA	RATE	FEE		RATE	FEE
BASIC FEE	[redacted]	[redacted]	[redacted]	$ 345	or	[redacted]	$ 690
TOTAL CLAIMS	13-20=	*0	x 9=	$	or	x18=	$
INDEP CLAIMS	1- 3=	*0	x39=	$	or	x78=	$
__ MULTIPLE DEPENDENT CLAIM PRESENTED			+130=	$	or	+260=	$
*If the difference in Col. 1 is less than zero, enter "0" in Col. 2			TOTAL	$	or		$ 690

___ Please charge my Deposit Account No. _____ in the amount of $_____ to cover the Filing Fee and _____ Assignment Recordation. A duplicate of this sheet is attached.

X Check No. 3667 in the amount of $690.00 to cover the Filing Fee and check no._____ in the amount of $_____ to cover the Assignment Recordation is enclosed.

___ The Commissioner is hereby authorized to charge payment for the following fees associated with this communication or credit any overpayment to Deposit Account No. _____. A duplicate of this sheet is attached.

___ Any additional filing fees required under 37 CFR 1.16.
___ Any patent application processing fees under 37 CFR 1.17.

Respectfully submitted,
JAMES RAY & ASSOCIATES

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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of:	)	Group Art Unit: TBA
	)	
SCOTT, Valerie Anne et al.	)	Examiner: TBA
	)	
Filed: To be determined	)	Attorney Docket: SG 99428
	)	
Serial No.: TBA	)	
	)	
For: OPTICAL SIGHT	)	Date: March 7, 2000

HON. COMMISSIONER OF
PATENTS AND TRADEMARKS
WASHINGTON, D.C. 20231

PRELIMINARY AMENDMENT

Sir:

Prior to examination of the above referenced application please amend it as follows:

In the specification:

On page 2, lines 12, 17 and 18, change "said" to --the--.

On page 2, line 21, after "invention", insert --,--.

On page 2, line 23, after "kind", insert --,--.

On page 4, line 19, change "said" to --the--.

On page 4, line 21, change "said layer" to --for--.

On page 9, line 28, change "said" to --this--.

On page 10, third line from the bottom, change "berating" to --breathing--.

In the claims:

Please amend the claims as follows:

1. (amended) Optical sight comprising:

an elongate housing defining a light channel;

a lens located at one end of the light channel and having a partially reflecting surface;

a laser diode for emitting light towards said reflecting surface to produce a light spot by direct imaging of [the] said laser diode on said reflecting surface, said light spot being [to be] superimposed on a target when sighting through the light channel from an opposite [the other] end thereof;

a battery for providing electric current; and

an energizing [energising] circuit for energizing [energising] said laser diode, operable to apply a pulsating electric current from said battery to said laser diode source for causing the laser diode to emit pulses of light.

4. (amended) Optical sight as in claim 1 wherein control means are provided for energizing [energising] the laser diode when a [the] weapon to which said optical sight is mounted is to be used and for automatically reducing energization [energisation] of the laser diode in dependence of a predetermined condition.

In claim 5, line 2, please change "energising" to --energizing--.

In claim 7, line 3, please change "deenergising" to --deenergizing--.

In claim 7, line 4, please change "having been energised" to --has been energized--.

In claim 8, line 4, after "mounted", please insert --is--. and in line 5, please change "deenergising" to --deenergizing--.

In claim 9, line 4, please change "energising" to --energizing-- and in line 5, please change "energised" to --energized--.

In claim 10, lines 3 and 5, please change "energising" to --energizing-- and in line 4, please change "energised" to --energized--.

In claim 11, line 4, please change "energising" to --energizing-- and in line 6, please changed "deenergising" to --deenergizing--.

In claim 12, line 3, please change "energising" to --energizing-- and in line 5, please changed "deenergising" to --deenergizing--.

In claim 13, line 1, please delete "any preceding" and after "claim", insert --1--.

REMARKS

The above amendment provides proper antecedent basis in the claims. Additionally, the claims have been amended to remove any multiple dependencies therefrom.

In the event the Examiner has further difficulties with the examination and/or allowance of the application, he/she is invited to contact the undersigned agent for applicant by telephone at (412)380-0725, if necessary to resolve any remaining questions or issues by interview and/or Examiner's Amendment as to any matter.

Respectfully submitted,
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Title of the invention

OPTICAL SIGHT

Background of the invention

Field of the invention

The invention relates to an optical sight used for example on a hunting weapon such as a hunting gun. The invention more particularly relates to a sight in which a light source creates a light spot which is superimposed on a target which is viewed through the sight.

Description of related art

Weapon sights comprising a light channel, a lens at one end of the light channel, having a partially reflecting surface, a light emitting diode (LED), and a battery for energising the light source have been available for approximately 20 years. In these sights, the energised LED emits light towards the reflecting surface of the lens to produce an image of a light spot which can be superimposed on a target when sighting through the light channel from the other end thereof. The intensity of the light spot is varied by altering the drive current of the LED.

The main problem with these sights is low battery life (approximately four hours of continuous use at the brightest spot intensity). As a result, the user must replace the battery at regular intervals. This can lead to various practical problems especially if the user is in some remote location and batteries are not readily available. Further, since the sight can be used in extreme conditions, the battery compartment must be made as a watertight enclosure which can be opened. This adds to production costs and generally reduces the overall robustness of the sight.

SE-B-378 450 and SE-B-449 262 teach that in order to save energy, the LED should be pulsed. Although such an arrangement increases the battery life of the sight, the resulting sight still has a low battery life of approximately forty hours of continuous use at the brightest spot intensity.

Brief summary of the invention

The optical sight of the invention comprises an elongate housing defining a light channel, a lens located at one end of the light channel and having a partially reflecting surface, a light source for emitting light towards said reflecting surface to produce an image of a light spot which is superimposed on a target when sighting through the light channel from the other end thereof, a battery for providing electric current, and an energising circuit for energising said light source operable to apply a pulsating electric current from said battery to said light source, for causing the light source to emit pulses of light.

According to the invention in order to increase many times the battery life in an optical sight of this kind a laser diode is provided as the light source therein. By using a laser diode the sight can be made substantially maintenance-free having a battery life of over 5000 hours of continuous use.

In the presently preferred embodiment of the sight according to the invention, control means are provided for energising the laser diode when the weapon is to be used and for automatically reducing energisation of the laser diode in dependence of a predetermined condition.

Reduced energisation of the laser diode also includes the condition wherein the laser diode is completely turned off.

In the presently preferred embodiment of the sight according to this invention, control means are incorporated to vary the intensity of the light spot.

The invention yields a significant increase of the overall efficiency of the sight because the laser diode has an electrical-to-(useful)optical efficiency, *i. e.* the efficiency in converting electric energy into useful optical energy which is used to produce the light seen by the user, which is considerably higher than the electrical-to-(useful)optical efficiency of a conventional LED as used in existing sights. Moreover, if the laser diode is energised only periodically, viz. during the periods when a weapon on which the sight is mounted, is in use or is ready for use, the battery will last for years, maybe for the lifetime of the sight, and therefore can be mounted in a permanently closed space in the sight so as to be exchanged only in the sight factory, e.g. in connection with maintenance service on the sight, no battery exchange being necessary in the field.

Brief description of the drawings

In order to explain the invention in more detail an illustrative embodiment thereof will be described below reference being made to the accompanying drawings in which

FIG 1 is an axial sectional view of a sight of the invention,

FIG 2 is a cross sectional view along line II - II in FIG 1,

FIG 3 is a block diagram of a complete electronics configuration for driving the laser diode and varying the intensity of the light spot via pulse width modulation,

FIG 4 is a similar block diagram as that in FIG 3 including also means for reducing the energisation of the laser diode via the use of a predetermined time-out of the sight of the invention, and

FIG 5 is a block diagram showing the interaction of a deenergisation sensor, which determines when the gun to which the sight is attached is in use, with the drive electronics for the laser diode.

Detailed description of the invention

The weapon sight disclosed in FIG 1 comprises a light tunnel formed by an outer tube 10 to be fastened to the barrel of a weapon on which the sight shall be used, and an inner tube 11 which is mounted in the outer tube at one end and is fixed at the other end by adjustment means allowing adjustment of the longitudinal axis of the inner tube in relation to the longitudinal axis of the outer tube as is necessary in order to adapt the sight to the weapon on which it is used. In said one end of the inner tube a double lens 12 is provided having a layer 13 between the lenses, said layer reflecting red light. Inside the inner tube a light source 14 comprising a laser diode is mounted which projects a beam of red light on the layer 13 which reflects the light beam through a face-ground glass plate 15 having an anti-reflexion layer on the side thereof facing the right end of the light tunnel. The light path is indicated by a dot-and-dash line 16 in FIG 1. The laser diode is energised via electronic drive circuitry by a battery 17 mounted in a closed housing 18 integral with the outer tube 10 and located e.g. on the side thereof as shown in FIG 2, the battery being electrically connected with the drive electronics for the laser diode by conductors (not shown). A

suitable battery for use in the sight of the invention is a lithium cell DL1/3N having a capacity of 160 mAh.

A representative laser diode for use in the sight of the invention is Sony SLD1122VS generating an optical output power of 5 mW at a forward current of 50 mA and a forward voltage of 2.2 V. The input power is therefore 110 mW and the electrical-to-optical efficiency 4.5 %. This laser diode converts electric energy to useful optical energy 4500 times better than the existing conventional LED. There are two main reasons for this. The first reason is that a laser diode fundamentally has a better efficiency than an LED wherein a proportion of the generated light is trapped inside the diode by total internal reflection, is reabsorbed and causes the LED to heat up. This does not happen in the laser diode. The second reason is that the conventional LED is used with a metal mask placed in front of the LED to reduce the size of the light source and consequently the size of the beam emitted therefrom. The mask causes a significant amount of the output power of the LED to be wasted. It is not necessary to mask the laser diode in this manner, since it is an inherently small source. For example, the Sony SLD1122VS has a source size of 1μm by 3μm.

The intensity of the light spot in existing sights is varied by altering the drive current of the LED. Varying the light spot intensity in the weapon sight of the present invention is not best done in this simple manner. The use of a laser diode introduces a complication due to the laser light-current characteristic. There is a threshold current below which the laser diode does not lase. Control of the output power of the laser diode by control of the drive current in the manner applied with an LED is difficult, particularly for low output power. This is because the

threshold current varies from one laser diode to the other and is also temperature dependent. Therefore, a better solution is to drive the laser diode into the lasing region and to control the output power of the laser diode by means of pulse width modulation.

If it is assumed that an average optical power output of 1 μW is typical for an LED used in a sight to produce the brightest spot intensity, then it is necessary to drive the laser diode at a duty cycle of 1 μW/5 mW = 2×10^{-4}. The average current taken by the laser diode to produce the brightest spot intensity is then $2 \times 10^{-4} \times 50$ mA = 10 μA.

FIG 3 shows a block diagram of a circuit according to this technique. The laser diode 14 is driven with pulses from a programmable pulse generator 19 powered from the battery 17 via a laser diode driver power control 20. The brightness of the laser diode is varied by changing the pulse length in accordance with the present invention. The user sets the desired spot brightness using a multi-position switch 21 which controls an oscillator 22 connected to the pulse generator 19.

An alternative embodiment of the circuit is disclosed in FIG 4, which incorporates an automatic time-out mechanism to reduce the energisation of the laser diode after a pre-determined length of time. This further increases the operational lifetime of the sight since there will be significant periods of time when there is little or no current consumption. The oscillator is replaced by a micro-controller 22' which reads the position of the switch 21 and sets the correct pulse length according to values in a look-up table stored in an EEPROM 23. When the unit is not in use, a micro-controller power control 24 powers the micro-controller 22' approximately once every second.

If the switch position has not changed since the unit was last used, the micro-controller resets a timer 25 and the power controller 24 turns off the power. If the switch position has changed, then the unit has started to be used. In this situation the micro-controller 22' continuously triggers the programmable pulse generator 19 at a rate sufficient that the pulsing of the laser light is not evident to the user. The rate would typically be around 200 Hz. The timer 25 is reset by changes in the position of the switch 21 and is used to implement a time-out function. If a pre-determined period has elapsed before the position of switch 21 has changed, it is assumed that the sight is no longer in use and that it can be switched off by micro-controller 22'. The period of this time-out would typically be several hours. For a period before the end of the time-out period, the micro-controllercontroller 22' causes the laser diode to pulse at a low rate, visible to the user, so as to indicate to the user that the end of the time-out period is approaching. This warning period would typically be of the order of 10 seconds. If the user wishes to continue to use the sight, he moves the switch 21 by at least one position, causing the timer 25 to be reset via the micro-controller 22' and re-initiating the time-out period.

In a practical embodiment of the circuit described means should be provided to compensate for the change in laser diode characteristics with temperature. One possible way of achieving this would be to incorporate a thermistor into the circuit in series with the laser diode to provide a compensation in the current as the temperature changes. Furthermore, the circuit should be made fail safe such that any failure of the circuit leads to the laser diode being turned off. The eye of the person using the sight should not be exposed to an

emission from the laser diode which is over the maximum permissible exposure limit.

The most simple solution for controlling the electronic circuit in order to have the laser diode deenergised during periods when a weapon on which the sight is mounted is not used and to energise the laser diode when the weapon is to be used and during use thereof is to include in the electronic circuit a time-out circuitry, as mentioned above. When the laser diode has been turned on, which can be effected for example by the user pressing a conveniently located push button switch, the time-out circuitry would simply automatically turn the laser diode off after a predetermined length of time - say several hours - after the laser diode has been turned on. Then, the user would just press the button again if he wishes continued use of the sight. The laser diode will then be energised for the predetermined time period. The time-out circuitry can include means for setting different lengths of the time-out. The end of the time-out period may be indicated to the user by causing the laser to flash at a rate visable to the human eye for a predetermined period before the end of the time-out period.

The electronic circuit can also include a detector which senses vibration and motion as long as a weapon on which the sight is mounted, is held by a user. When the laser diode has been turned on by the user actuating a switch in order to bring the weapon into use the laser diode will be turned off by a switch controlled by the detector when vibration or motion is no longer sensed by the detector due to the weapon no longer being held by the user. The detector can comprise e. g. a piezoelectric element. The vibration or motion signal can be integrated over the time and

the laser diode can be turned off when the integrated signal falls below a predetermined threshold value.

Typically, weapons are stored in a different orientation to that in which they are shot. Either they may be stored vertically or lying on their side while they tend to be shot horizontally and upright. A tilt sensor can be provided to detect when the weapon is in a normal orientation for shooting and then the sensor can actuate a switch incorporated into the electronic circuit, in order to turn on the laser diode. When the weapon is put into a "non-shooting" position the laser diode will be turned off by the sensor actuated switch.

When a motion or vibration detector or a tilt sensor is provided for controlling energisation of the laser diode it may be desirable to have an override option which allows the laser diode to remain turned on also when no motion or vibration is detected or the weapon is in a "non-shooting" orientation. This override option can be protected by a time-out circuitry to prevent the laser diode from being left turned on unintentionally.

For daytime usage of a weapon on which the sight is mounted a photodiode for detecting ambient light could be included into the electronic circuit. When the ambient light is above a certain threshold level the laser diode should be turned on under the control of the photodiode, and when the ambient light is below said threshold value the current to the laser diode is reduced to a minimum setting under the control of the photodiode. This will allow operation of the sight at night and will also reduce the power consumption to its minimum level when the weapon is stored in the dark. If the weapon is to be stored in a light area the laser diode should not of course be turned on by the photodiode under the influence of ambient light. In

this case the laser diode should be turned on by means of a manually operated switch possibly combined with a time-out function.

The laser diode requires to be turned on only when a user of a weapon on which the sight is mounted actually is looking through the sight. Therefore, a good method of determining when the sight is being used is to detect the presence of the eye. A low level IR source can be mounted inside the sight in the inner tube 11 thereof and facing towards the location of the eye. When the eye is present there would be reflection of the IR from the cornea and retina which can be detected to confirm the presence of a user. The red dot generated by the laser diode could itself be used as the illumination source which reflects off the eye. This solution requires less power since the sight would then contain only one light source. By pulsing the light source the reflected light could be distinguished from the ambient light.

The periodic blinking of the eye could be used as confirmation that the sight is being used. Combining detection of the eye reflection and the interruptions caused by blinking would enable reflection from inanimate items or other body parts to be distinguished.

The heat radiated from the user's face or the vibration introduced by the user's breathing also could be used for turning the laser diode on and off. For sensing the heat a temperature sensitive resistor can be mounted at the entrance of the sight. A motion or vibration sensor, such as a piezoelectric element or an accelerometer can be used as sensing element for the user's berating.

FIG 5 summarizes in a block diagram the different methods of controlling energisation of the sight. A

sensor 26 sensing the existence or non-existence of a predetermined condition controls the micro-controller 22' in the electronics (FIG 4) for the laser diode 14 so as to energise the sight when the weapon is to be used and keep it energised during use, and/or to deenergise the sight when the weapon is no longer in use.

CLAIMS

1. Optical sight comprising:

an elongate housing defining a light channel;

a lens located at one end of the light channel and having a partially reflecting surface;

a laser diode for emitting light towards said reflecting surface to produce a light spot by direct imaging of the said laser diode on said surface to be superimposed on a target when sighting through the light channel from the other end thereof;

a battery for providing electric current; and

an energising circuit for energising said laser diode, operable to apply a pulsating electric current from said battery to said laser diode source for causing the laser diode to emit pulses of light.

2. Optical sight as in claim 1 wherein control means are provided for adjusting the intensity of the light spot.

3. Optical sight as in claim 2 wherein said control means comprise pulse width modulation of the laser diode source.

4. Optical sight as in claim 1 wherein control means are provided for energising the laser diode when the weapon is to be used and for automatically reducing energisation of the laser diode in dependence of a predetermined condition.

5. Optical sight as in claim 4 wherein said control means comprises a switch for energising the laser diode.

6. Optical sight as in claim 5 wherein said switch is a manually operated switch.

7. Optical sight as in claim 4 wherein said control means comprises a time-out circuit for deenergising the laser diode a predetermined period after the laser diode having been energised.

8. Optical sight as in claim 4 wherein said control means comprises a motion sensor for detecting vibration and motion of the sight when a weapon to which the sight is mounted being held by a user of the weapon and for deenergising the laser diode when no vibration and motion being detected.

9. Optical sight as in claim 4 wherein said control means comprises a sensor for detecting the orientation of a weapon to which the sight is mounted for energising the laser diode and maintaining the laser diode energised as long as the weapon is held by a user thereof in normal orientation of use.

10. Optical sight as in claim 4 wherein said control means comprises a sensor for detecting the presence of ambient light for energising the laser diode and maintaining the laser diode energised at lightness and reducing the energising of the laser diode in darkness.

11. Optical sight as in claim 4 wherein said control means comprises a sensor for detecting the presence of an eye looking through the sight, for energising the laser diode when an eye is looking through the sight and maintaining the laser diode deenergised in the absence of an eye looking through the sight.

12. Optical sight as in claim 4 wherein said control means comprises a detector for detecting a phenomenon associated with a human being for energising the laser diode when detecting said phenomenon and deenergising the laser diode in the absence of such phenomenon being detected.

13. Optical sight as in any preceding claim wherein the wave length of the light emitted by the laser diode ranges from 630 to 700 nm.

ABSTRACT

An optical sight comprises an elongate housing defining a light channel. A lens is provided at one end of the light channel and has a partially reflecting surface. A laser diode is energised by a pulsating electric current delivered by a battery powered energising circuit, and the energised laser diode emits light towards the reflecting surface to produce a light spot by direct imaging of the laser diode on the surface. The light spot shall be superimposed on the target when sighting through the light channel from the other end thereof.

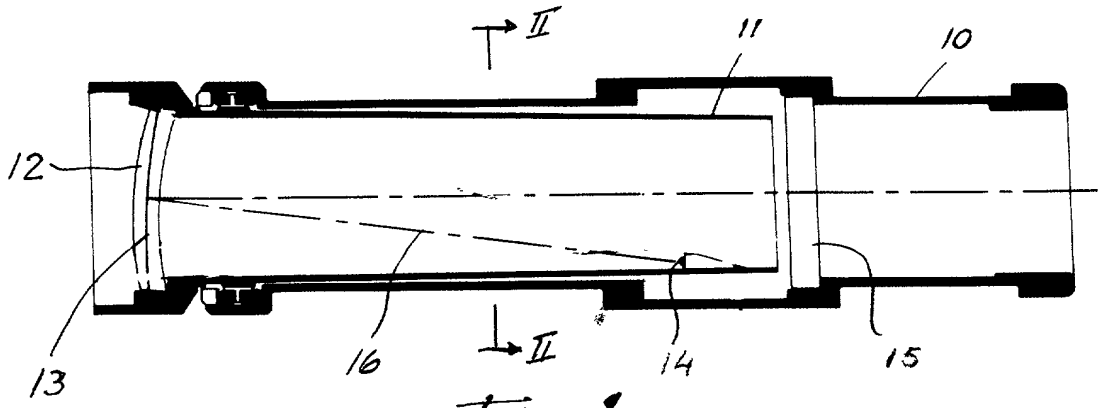

Fig. 1

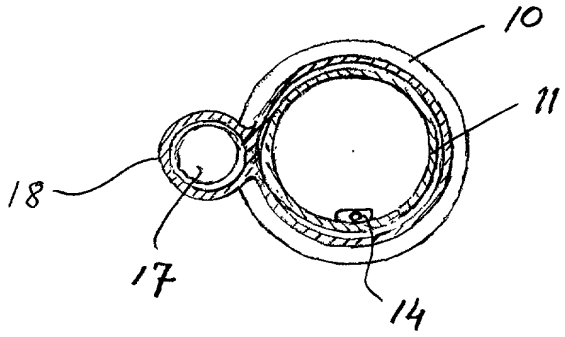

Fig. 2

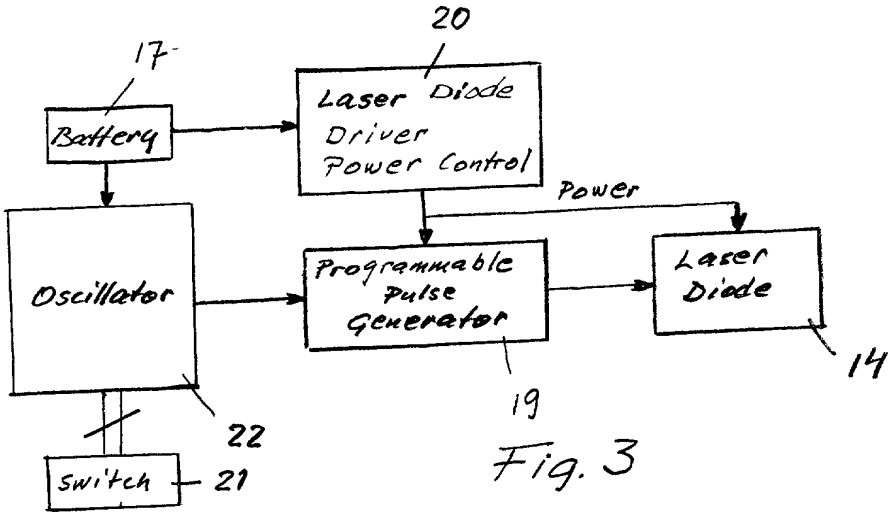

Fig. 3

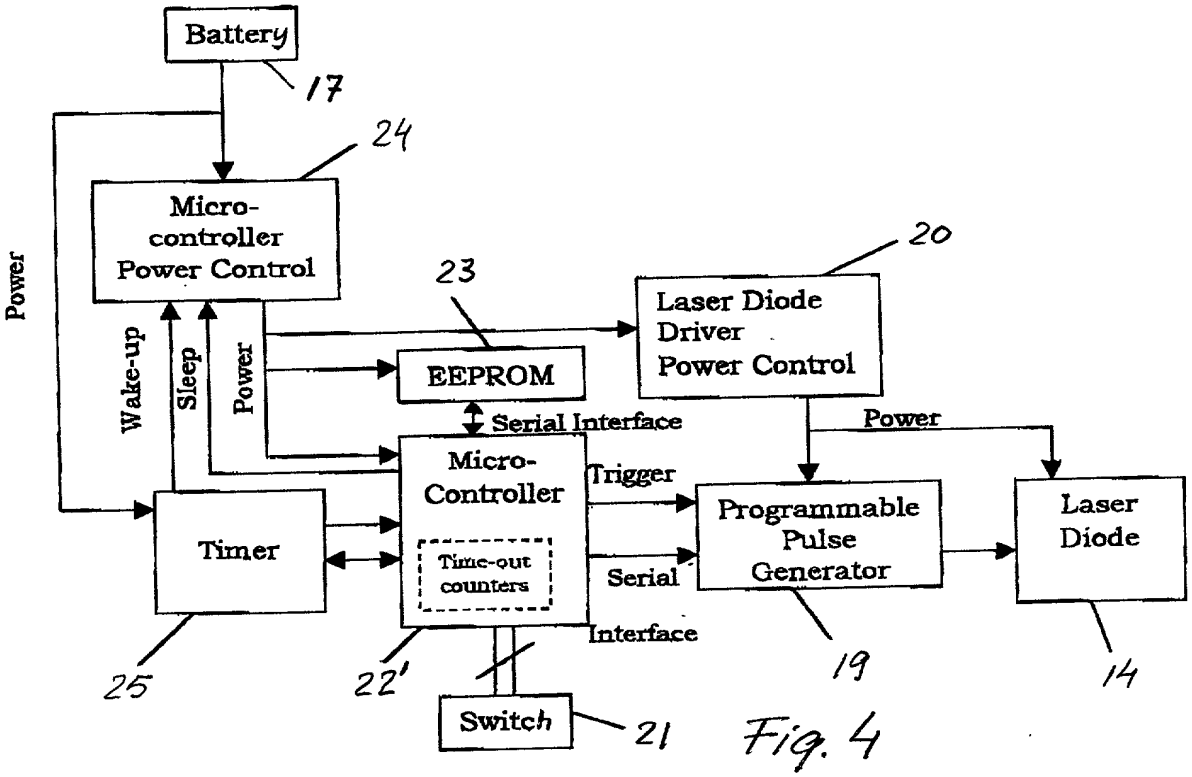

Fig. 4

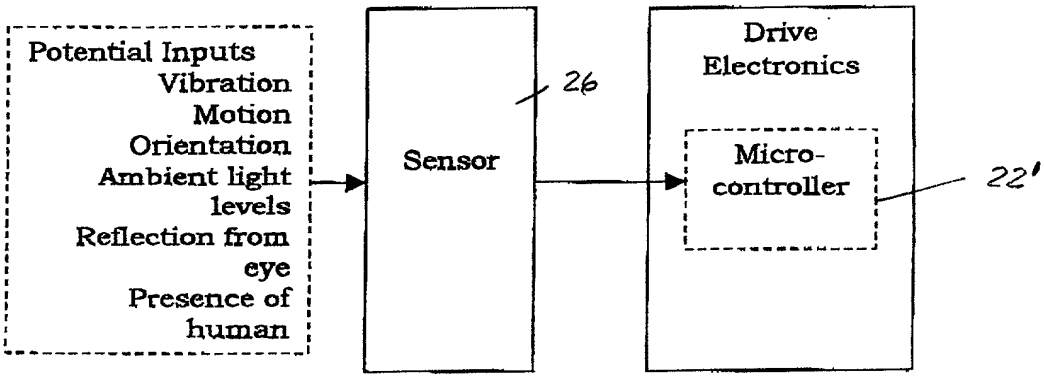

Fig. 5

P576-040 US

Attorney Docket No.: SG 99428

Declaration For U.S. Patent Application

(PTO/SB/01)

As a below named inventor, I hereby declare that.

My residence, post office address and citizenship are as stated below next to my name.

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled

OPTICAL SIGHT

the specification of which (Check one of blocks 1, 2 or 3)

1. [**X**] is attached hereto.
2. [ ] was filed on _____ as International PCT Application Serial No. _____ and was amended on _____. (if applicable)
3. [ ] was filed on _____ as U.S. Application Serial No. _____ and was amended on _____.(if applicable).

I hereby state that I have reviewed and understand the contents of the above-identified specification, including the claim(s), as amended by any amendment referred to above.

I acknowledge the duty to disclose information which is material to patentability as defined in 37 C.F.R. 1.56

I hereby claim foreign priority benefits under 35 U.S.C. 119(a)-(d) or 365(b) of any foreign application(s) for patent or inventor's certificate, or 365(a) of any PCT international app ication which designated at least one country other than the United States of America, listed below and have also identified below any foreign application for patent or inventor's certificate, or of any PCT international application having a filing date before that of the application on which priority is claimed:

List of Prior Foreign Applications (if applicable)

(Application Number)	(Country)	(Day/Month/Year Filed)	CERTIFIED COPY ATTACHED?
9916676.1	ENGLAND	15 JULY 1999	[X] Yes [ ] No
			[ ] Yes [ ] No
			[ ] Yes [ ] No
			[ ] Yes [ ] No

[ ] Additional foreign application numbers are listed on the attached sheet, PTO/SB/02B - Supplemental Priority Data Sheet or similar sheet.

I hereby claim the benefit under 35 U.S.C 119(e) of any United States provisional application(s) listed below:

List of U.S. Provisional Applications (if applicable)

(Application Number)	(Day/Month/Year Filed)

[ ] Additional provisional application numbers are listed on the attached sheet, PTO/SB/02B - Supplemental Priority Data Sheet or similar sheet.

I hereby claim the benefit under 35 U.S.C. 120 of any United States application(s), or 365(c) of any PCT international application designating the United States of America, listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States or PCT international application in the manner provided by the first paragraph of 35 U.S.C. 112, I acknowledge the duty to disclose information which is material to patentability as defined in 37 C.F.R. 1.56 which became available between the filing date of the prior application and the national or PCT international filing date of this application:

List of U.S. Parent Application Or PCT Parent Numbers (if applicable)

(Number)	(Day/Month/Year Filed)	(Status: Abandoned; Pending; Patent Number, if applicable)

[ ] Additional U.S. or PCT international application numbers are listed on the attached sheet, PTO/SB/02B - Supplemental Priority Data Sheet or similar sheet.

And I hereby appoint as principal attorneys and agents, James O. Ray, Jr., Reg. No. 27,666; Forest C. Sexton, Reg. No. 22,054; Edmond S. Miksch, Reg. No. 38,558; James R. Stevenson, Reg. No. 38,755; John B. Sotak, Reg. No. 20,529; Gary J. Falce, Reg. No. 29,304; Elroy Strickland Reg. No. 22,546; Amos Bartoli, Reg. No. 42,299; Michele K. Yoder, Reg. No. 41,562 and Robert A. Shack, Reg. No. 29,976.

Please direct all correspondence to the following address:

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FACSIMILE: 412-380-0748

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true: and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under 18 U.S C. 1001 of Title and that such willful false statements may jeopardize the validity of the application or any patent issue thereon.

Full Name of Sole or First Inventor: ~~VALERIE ANN SCOTT~~ VALERIE ANNE SCOTT

Inventor's signature: Valerie A. Scott Date: 21/2/00

Residence: ~~50 MAIDS CAUSEWAY, CAMBRIDGE CB5 8DP, GREAT BRITAIN~~ 319 NEWMARKET ROAD CAMBRIDGE, CB5 8JE GREAT BRITAIN.
(Street, City, State, Zip Code, Country)

Citizenship. BRITISH

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Full name of Fourth Inventor: _____

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[ ] Additional inventors are listed on the attached sheet, PTO/SB/02A - Supplemental Additional Inventor(s) Sheet or similar sheet.